separate works and articles in Transactions, &c., arranged under (1) authors, (2) anonymous works and reports by institutions, and (3) articles relating to Mexican meteorology in foreign periodicals. There is also a list of works on earthquake phenomena, and a classified index of subjects for easier reference.

THE Burmah Administration Report for the past year says that the total approximate area topographically surveyed in Burmah last year was 31,680 square miles, of which nearly 9620 square miles were surveyed by the Anglo-Siamese Boundary party. The total cost of these surveys was £16,880. A cadastral survey party worked in Kyaukse from November 1889 till July 1890, and surveyed 550 square miles, at a cost of over £18,500. Surveys of State lands were undertaken in several districts in Upper Burmah by small detachments of local surveyors. These parties surveyed nearly 81,000 acres in six districts.

SODIUM amide, NH_2Na, forms the subject of a communication by M. Joannis to the current number of the *Comptes rendus*, This interesting compound was supposed to have been obtained by Gay Lussac and Thénard in the form of an olive-green readily fusible substance, by heating metallic sodium in ammonia gas. The product of this reaction, however, can scarcely have consisted of pure sodamide, for M. Joannis has now obtained the isolated compound in well-defined colourless crystals, and analyzed it. He first prepared the curious substance sodammonium, first obtained by Weyl, who liquefied ammonia by heating the compound of ammonia with silver chloride at one end of a sealed tube and allowed the liquid to collect at the other cooled end of the tube in contact with metallic sodium. It has been stated that the deep blue liquid thus formed is merely a solution of sodium in liquid ammonia. However this may be, M. Joannis finds that sodammonium decomposes spontaneously at the ordinary temperature into hydrogen and sodamide. NH_2Na. The decomposition occurs rather more quickly in sunshine than in the dark, but under any circumstances is very slow, only about a third of a cubic centimetre of hydrogen being evolved per gram of sodammonium in twenty-four hours. As the decomposition slowly progresses, however, small transparent colourless crystals make their appearance, whose average diameter is about one millimetre. Upon analysis, they yield numbers agreeing with the formula NH_2Na. When thrown into water a most lively action occurs, just as if the crystals had consisted of globules of red-hot metal, violent hissing occurring without the evolution of any gas except water vapour. The solution is found to contain only soda and ammonia. Sodamide may be prepared in much larger quantities and in very much less time by allowing saturated water solutions of sodammonium and sodium chloride to react upon each other at the temperature of melting ice. Under these conditions hydrogen is liberated to the extent of one equivalent for every equivalent of sodammonium. The solution remains blue until the sodium chloride is in excess, when it becomes colourless. The white solid product of this reaction is then washed with liquefied ammonia (NH_3) to remove the sodium chloride; the last traces of chlorine are found to be eliminated after several such washings. The residual substance is sodamide. This remarkable action of sodium chloride is due to the formation of an unstable intermediate compound, NH_2Na_2Cl, which is obtained, mixed with sodium chloride, when metallic sodium is treated with excess of sodium chloride in presence of a quantity of liquefied ammonia insufficient to dissolve the whole of the sodium chloride. On treating the compound with further quantities of liquefied ammonia it is decomposed into sodium chloride which dissolves, and sodamide which is left in a pure state. This compound, NH_2Na_2Cl, behaves quite differently with water to sodamide; it dissolves quietly without the least hissing, with formation of a solution of ammonia, soda, and common salt.

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus* ♀) from India, presented by Mr. Henry Williams; a Green Monkey (*Cercopithecus callitrichus* ♂) from West Africa, presented by Mr. A. Mann; a Grey Ichneumon (*Herpestes griseus* ♀) from India, presented by Mr. J. Seymour Bartlett; a Jack Snipe (*Gallinago gallinula* ♂), a Common Buzzard (*Buteo vulgaris*), British, presented by Mr. W. H. St. Quintin; a Little Grebe (*Tachybaptes fluviatilis*), British, presented by Miss E. Bartlett; two Burbot (*Lota vulgaris*) from the Trent, presented by Mr. T. F. Burrows; a Scaup (*Fuligula marila* ♂), a Curlew (*Numenius arquata*), European, purchased.

OUR ASTRONOMICAL COLUMN.

THE SOLAR SPECTRUM AT MEDIUM AND LOW ALTITUDES. —Dr. Ludwig Becker, of the Royal Observatory, Edinburgh, has made a series of interesting observations of the solar spectrum at medium and low altitudes (Trans. Roy. Soc. Edin., vol. xxxii. Part 3, 1890). The region observed was between the wave-lengths 6024 and 4861. The method usually adopted for determining the wave-lengths of lines in the solar spectrum is by means of the reading of the vernier attached to the observing telescope. Dr. Becker has determined them by clamping the telescope, and recording the exact positions of a movable diffraction grating when the lines are successively brought to the fixed cross-wire in the field of view. Using one of Rowland's gratings, the angular interval between the two positions of the grating which bring the components of the E_1 line to the same direction was one second of arc in the second-order spectrum. This small angular movement has been multiplied 16,800 times by gearing several pairs of wheels and pinions together, and attaching the grating to the fastest wheel of the train. To make an observation, the observer turns the slowest wheel. The motion is transmitted by means of other wheels and endless screws, until it slowly rotates the grating and causes the lines of the spectrum to move across the fixed field of view. When the line under observation coincides with the intersection of the wires, the observer depresses one or more needles according to its degree of blackness, and the pricks thus made are recorded on a fillet of paper which is moved by another specially devised piece of apparatus. As to the linear distances between two lines on the paper, it is noted that the D lines are $19\frac{3}{4}$ inches apart, whilst the whole region of observation, λ 6024 to λ 4861, requires a strip 314 feet long. With respect to the work done, it need only be said that the memoir contains a catalogue of 3637 lines of the solar spectrum, including 928 telluric lines, between the above-mentioned limits. If 28 lines be excepted, the whole telluric spectrum is found by these observations to consist of three bands ranging from λ 6020 to λ 5666, λ 5538 to λ 5386, and λ 5111 to λ 4981, and containing respectively 678, 106, and 116 lines. Dr. Becker's investigations, combined with the results obtained by other observers, lead him to believe that the water-vapour lines of the first of the above-named bands are split into two distinct groups by a band of faint lines, which are probably due to oxygen. These two groups have been called the rain-band and the δ-band. They were known to Brewster, and his drawing of telluric absorption bands gives also the other two bands under the designation ζ and ι, besides some other bands which do not appear to be due to atmospheric absorption.

The water-vapour band (ι) between *b* and F is described by Ångström as very strong in summer. It is the same which Mr. Maxwell Hall has utilized as a rain-indicator at Jamaica.

Dr. Becker's memoir is a most important one, and all the methods of observation and reduction of observations are fully explained. The probable error in the determination of wave-length from the fillet of paper is said to be about $\pm 0{\cdot}02\ \mu\mu$, but, of course, differs slightly with the intensity of the line observed. The catalogue of lines contains oscillation frequencies, as well as wave-lengths, and many details of value. The maps have been well reproduced by photo-lithography, and show the intensities of blackness of the solar and telluric lines as they would appear at medium altitudes of the sun for an average amount of water-vapour, and the intensities of the telluric lines only when the apparent altitude of the sun is 1° or 2°. It is unnecessary to comment upon this addition to our

©1891 Nature Publishing Group

knowledge of the telluric spectrum. The author must be glad that his laborious observations have led to such tangible results.

A METHOD OF MEASURING ATMOSPHERIC DISPERSION.—At the Paris Academy on February 16, M. Prosper Henry described a novel method for determining atmospheric dispersion and its variation with the wave-length of the light observed. A *reseau*, formed of Bristol board perforated very regularly with holes about 1 millimetre apart, was placed in front of the object-glass of a telescope as a diaphragm. When a luminous point, not affected by atmospheric refraction, is observed through this arrangement, a double series of spectra are seen besides the central image of the point. M. Henry shows that by knowing the zenith distance of a star, and the size of the meshes of the *reseau*, the value of atmospheric dispersion (D) may be found by determining the angular distance of any particular part of the spectrum from the central luminous point. A large number of stars have been observed at Paris Observatory, and from them D has been found to be 0″·723 for eye observations, whilst the value 0″·729 has been deduced from photographs. The most probable value may therefore be taken as 0″·726. If the wave-length of the maximum light intensity of the spectrum be taken as 575 $\mu\mu$, and the average amount of atmospheric refraction (A) for an object having a zenith distance of 45° be 58″·22, it is found that

$$A = 56''\cdot55 + \frac{0''\cdot726}{\lambda^{\frac{3}{2}}}.$$

This formula gives the following values for light of different wave-lengths:—

Wave-length. $\mu\mu$		Average atmospheric refraction. ″
700	... ...	57·79
600	... ...	58·11
575	(maximum light intensity)	58·22
500	... ...	58·66
430	(maximum chemical intensity) ...	59·13
400	... ...	59·42

It will be seen that the most intense chemical rays give a value of A 0″·91 higher than that furnished by light of maximum luminosity.

The comparison of the different dispersive effects of the atmosphere on light of different wave-lengths indicates that, in the latitude of Paris, the green portion of the solar spectrum ought to be visible about a second after the disappearance of the yellow. This explains the phenomena noted by the late M. Thollon and other observers of the telluric spectrum. It is found that, in the majority of cases, the last light visible at sunset is in the blue part of the spectrum; this green or blue light is a limit of the visible spectrum when the sun is on the horizon, the more refrangible rays being absorbed by the atmosphere.

WOLF'S "RELATIVE NUMBERS" FOR 1890.—*Comptes rendus* for February 16 contain the "relative numbers" obtained by Wolf from a reduction, by the usual method, of the solar observations made at various Observatories in 1890. The following table shows the mean values (r) obtained for each month in the year, the mean variations (v) in magnetic declination observed at Milan, and the increments (Δr, Δv) that these quantities have received since the corresponding epochs of 1889:—

	Solar Observations.		Magnetic Observations.	
	r	Δr	v	Δv
Jan.	5·3	+ 4·5	3·02	+1·27
Feb.	0 6	− 7·9	4·81	+0·82
March	5·1	− 1·9	7·49	+1·32
April	1·6	− 2·7	8·68	−0·17
May	4·8	+ 2·4	7·70	−0·49
June	1·3	− 5·1	8·84	−0·02
July	11·6	+ 1·9	8·57	+0·32
Aug.	8·5	−12·1	8·00	−0·99
Sept.	17·2	+ 0·7	7·10	+0·26
Oct.	11·2	+ 9·1	8·72	+2·62
Nov.	9·6	+ 9·4	3·10	+0·55
Dec.	7·8	+ 1·1	2·54	+0·58
Means	7·1	+ 0·8	6·55	+0·51

NEW ASTEROIDS.—M. Charlois discovered (303) on February 11, Prof. Millosevitch (304) on the following day, and Dr. Palisa (305) on February 14.

THE BRITISH MOSSES.[1]

II.

LEAVES.—When we examine the leaves of mosses and compare them with the more familiar forms presented to us by the phanerogams, we find ourselves in a new world, and the interest with which we view them is increased when we remember that, according to the view usually accepted, they are, so to speak, a unique phenomenon: they are not the descendants of any earlier leaves nor the ancestors of any later ones; they appear thus once, as it were, in the history of the vegetable kingdom, and advance no further. They possess something of the charm which an *ἅπαξ λεγόμενον* exercises over the mind of a philologist.

We may first note what they are not. They are never opposite, never whorled, never on leaf-stalks, never truly veined, never lobed or compound, never furnished with epidermis or stomata.

When we turn to consider affirmatively what moss leaves are, we find them in some cases characterized by an extreme simplicity of form. They are single plates of similar cells without midribs, without veins, and without border; again, they stand in immediate connection with the atmosphere, absorbing moisture from it when moist, and shrinking and shrivelling when the air is dry. In some cases they are characterized by a marked difference in the form of the cells in the different parts of the leaf, and again in other cases by the unequal distribution of chlorophyll; in other cases we come across strange forms, the like of which we hardly know in the phanerogams: such are the thick border and double rows of teeth in some of the genus Mnium; the parallel plates in Polytrichum; and, stranger still, the third flange of the leaf in Fissidens, the true homology of which has proved a *crux* to bryologists.

In some cases the leaf is produced into a long thread or beak devoid of chlorophyll, and often with indented or toothed edges. This structure is found chiefly in mosses living on stones and rocks and in dry situations, such as Grimmia and Racomitrium, and the presence of these long white threads or beaks gives a grey tint to the whole moss; and in places where the moss is predominant (as, for instance, some parts of Dartmoor and North Wales, where Racomitrium abounds) a grey tint to the whole landscape. These long hairs and prominences, especially when armed with lateral teeth, no doubt retain the moisture which is necessary not only for the vegetative life of the moss, but also for the process of reproduction by archegonia and antheridia; hence it probably is that this form of leaf prevails in mosses living in dry situations, just as the thick leaves of succulent plants are found in similar situations.

The Roots or Rhizoids of the mosses are distinguished by the minuteness of their growing ends, by their pliancy, and by the presence on their exteriors of a balsamic or glutinous deposit. To these points of structure they owe their capacity to insinuate themselves into the minutest crevices of rock, to get, for instance, amongst the particles of the oolites, and also to fix themselves in the shifting sands of the sea-coast, and by so fixing themselves to give fixity in return to the sand, and so tend to produce the sand-dunes in many parts of the coast. At some parts of the Northumbrian coast the *Racomitrium canescens* may be found buried deep in the sand, from which it can scarcely be detached, and in like manner the sand-dunes of Holland and the west of France have in many places been fixed by mosses. The forests of firs on the North Sea and the Bay of Biscay thus owe their origin to humble mosses.

Sphagnaceæ.—Vast tracts of land in this country and throughout Northern Europe and America are covered with plants of this group, and large tracts which are now fertile agricultural land, where they have entirely ceased to grow, have in former times been occupied by them. The bogs of Ireland, which are mainly constituted of turf moss, were computed in 1819 by the Bog Commissioners to occupy 2,830,000 acres. No moss has probably ever, at least in the present state of the globe, played so large a part as the Sphagnum or peat moss.

Structure.—It is to the peculiar structure of the peat moss that this great part on the theatre of the globe is to be attributed.

Leaves.—In the young leaves the component cells are all alike; then by a differential growth we are presented with square cells surrounded by four narrow and oblong ones; then

---

[1] The substance (with omissions and additions) of a Discourse by the Right Hon. Lord Justice Fry, delivered at the Royal Institution, January 23, 1891. Continued from p. 382.

©1891 Nature Publishing Group